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A VERSATILE PLOT THRESHER

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A VERSATILE PLOT THRESHER¹

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Plant scientists and agricultural engineers for many years have felt the need of a machine suitable for threshing small quantities of seed of many and varied species of crops grown or handled for experimental purposes. Small threshers have been constructed for plot work and some have served well for specific crops. None have been suitable, however, for all of a wide range of seed, such as fluffy seeded grasses, hard to hull clovers, and the cereal grains.

The need for a versatile thresher as a research tool became acute recently in Oregon where research is underway on several phases of seed production including harvesting and the farm cleaning and handling of seeds.

One of the first steps in developing the thresher was the determination of service requirements the most important of which are: (1) adequate separation space for handling large quantities of straw or chaff, (2) wide range of adjustments, (3) adequate indicators and controls, (4) ease of cleaning, and (5) mobility. A thresher for meeting these service requirements has been constructed and used during the 1954, 1955, and 1956 harvest seasons at Corvallis, Oregon. According to observations and experiences of users, this thresher has proved to be the most satisfactory one yet developed as a research tool in handling small lots of seed crops for experimental purposes.

The new plot thresher, (figure 1), is mounted on a two-wheel trailer equipped with pneumatic tires. The overall height was held to a minimum without jeopardizing the gravity flow of material through the machine. The heavy parts such as the motor, the fan, and the cylinder are located so that the center of gravity is low. The machine is slightly off balance to the front or trailer hitch end, but a 20-lb. lift on the tongue will equalize the load for coupling the trailer hitch and for rolling the machine by hand. The low center of gravity and balance makes the unit well suited for handling and transporting. The thresher is equipped with a ball-joint trailer hitch and can be towed with an automobile or truck at highway speeds up to 50 miles per hour.

The principal features of the machine are: A feeding platform, sample storage pan, feed regulating cylinder, threshing cylinder and concave bars, retarding cylinder, screening sieve, air supply fan, electric motor, seed catch pan, and the necessary belts, chain, pulleys, and air ducts to make the machine a complete working unit. The main parts of the thresher are shown in Figures 2 and 3.

¹ Based on research conducted cooperatively by the Oregon Agricultural Experiment Station, Field Crops Research Branch, and Agricultural Engineering Research Branch.



FIGURE 1. --Plot thresher constructed in cooperation with the Oregon Agricultural Experiment Station and the United States Department of Agriculture.

The feed-regulating cylinder meters the flow of material into the threshing cylinder and is driven through a spring-loaded slip-clutch at 65 rpm. This feed control prevents overloading of the machine, aids in feeding a constant quantity of unthreshed material into the cylinder, and prevents the threshing cylinder from throwing seed, straw, and foreign material that might cause loss of seed and injury to the operator. The slip-clutch serves a two-fold purpose: (1) It is a safety feature that reduces the possibility of serious injury to the operator as it would stop should the operator get his hand in the feeder, and (2) it serves as a protection to the thresher from large objects, such as sticks or tools, which might accidentally be fed into the machine along with the crop.

The threshing cylinder is constructed from parts of an AC all-Crop Harvester No. 40 cylinder². The rubber-covered angle bars are mounted on a sheet steel covered drum 28" in length. With the angle bars attached this cylinder is approximately 15" in diameter. Three rubber concave bars are mounted above the cylinder so that threshing is accomplished by the over-shot principle. The concave bars are parallel with the cylinder but bars on the cylinder are mounted at a slight angle. This bar arrangement seems to minimize vibration, gives uniform distribution of material, and evens out the cylinder power requirements. The rubber-covered angle bars and concaves cushion the initial impact between the seed and the rapid moving bars, thereby reducing seed damage.

² Manufacturers name given for information purposes only and does not imply that the Government endorses the product as to quality or performance.

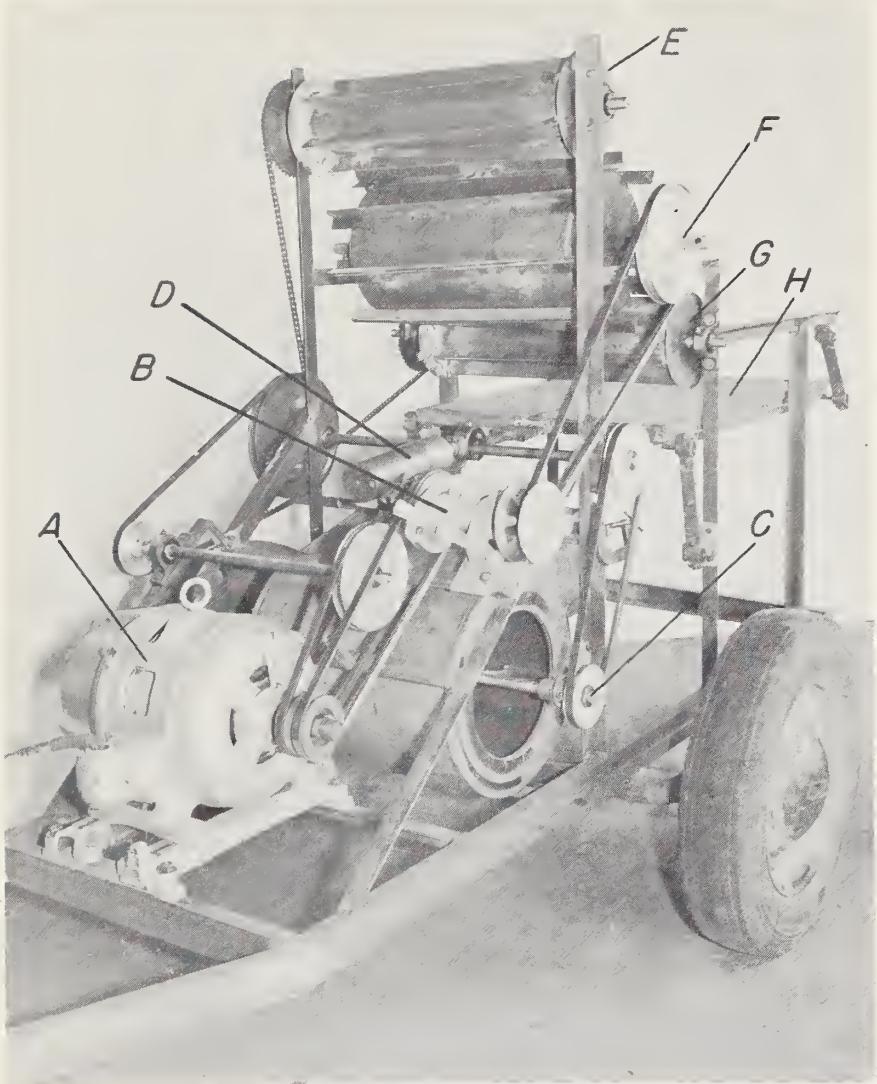


FIGURE 2. --Plot thresher under construction, showing pertinent parts prior to installation of the sheet metal hoods and housings: A, The motor; B, the threshing cylinder speed changer; C, the fan; D, the sieve counter weight; E, the feeder cylinder; F, the threshing cylinder; G, the retarder cylinder; and H, the adjustable sieve.

The cylinder is equipped with a variable speed V-belt drive. With this drive and a speedometer on the cylinder shaft, and desired cylinder speed can be obtained between 400 and 2,000 rpm, which in turn, gives a peripheral speed range from 1,570 to 7,854 feet per minute. A chart is mounted near the speedometer which shows peripheral speeds corresponding to revolutions per minute.

The cylinder-concave clearance is accurately controlled by lever-operated cams which change the cylinder-concave distance $1/32"$ for each $1/4"$ movement of the lever. The space between concaves and cylinder can be set as desired within the range of $1/64"$ to $1"$ and the setting can be changed while the machine is in operation. An indicator is used for showing the setting obtained.

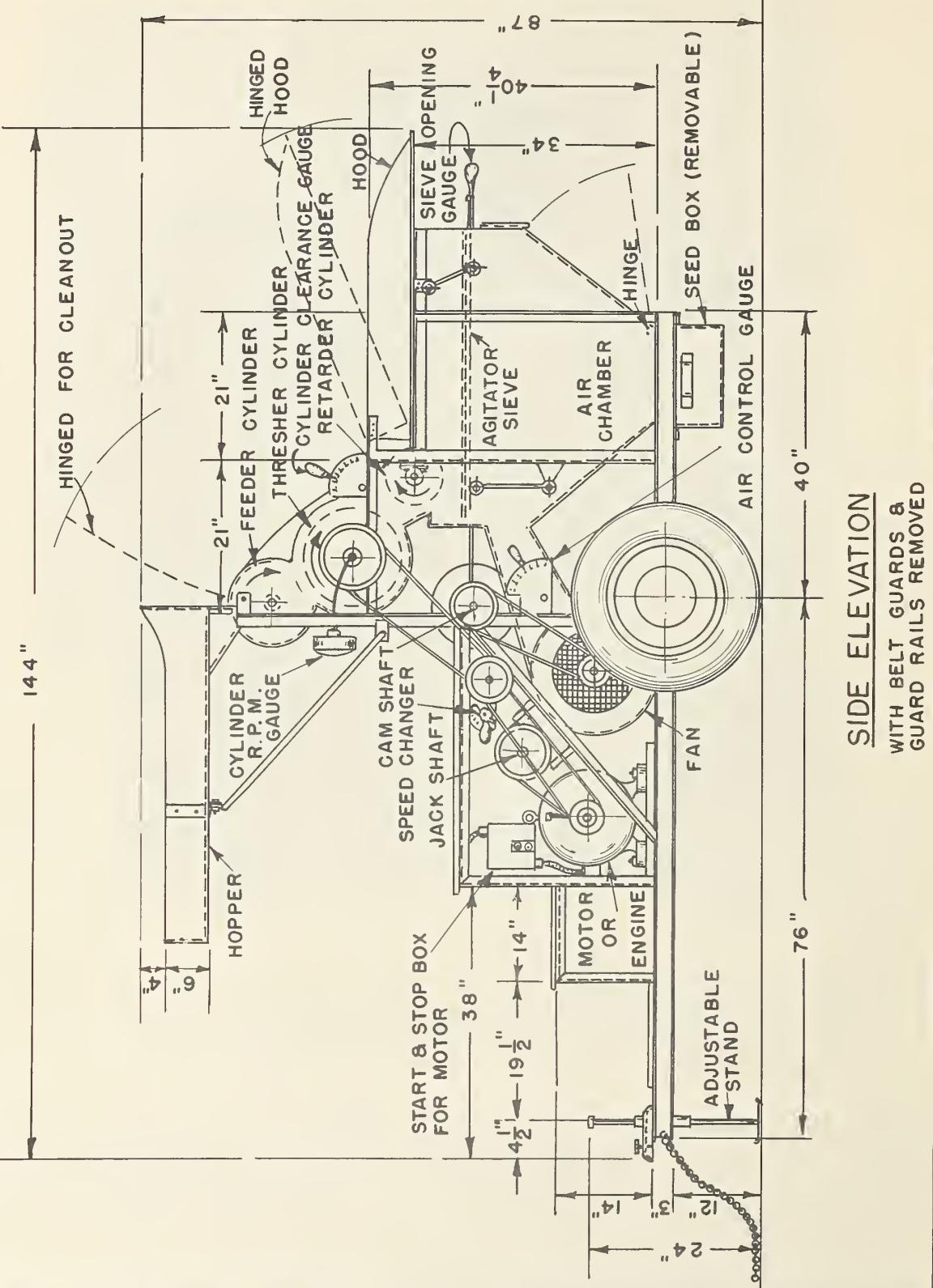


FIGURE 3

A retarder cylinder, which runs at 65 rpm, checks the speed of the threshed material and deposits it evenly across the full width of the sieve. The sieve is a standard Case A-6 combine² adjustable sieve altered so that the openings are set by means of a lever. A graduated scale and pointer are used to show sieve openings from completely closed to 1 inch open. The sieve can be quickly set to any size to suit the seed that is being threshed. The sieve is operated at a constant speed of 370 rpm by a 7/16" throw cam. To reduce the vibration, a second 7/16" throw cam is mounted on the same shaft and set to directly oppose the throw of the screen cam, activating a counter weight. The desired screen angle is accomplished by raising or lowering the adjustable stand-post under the trailer tongue.

The cleaning air fan is a standard AC All-Crop Harvester No. 40 unit equipped with tiger-toothed baffles in the discharge duct². The baffles are adjusted by means of a lever that moves the baffle linkage and controls the volume and distribution of air to the sieve. The air velocity can be adjusted from no flow up to 3,500 feet per minute. An indicator shows the position of the baffles. The fan has two speeds--approximately 632 rpm for high and 217 rpm for low. The speeds are obtained by changing pulleys on the fan drive.

The threshing machine is designed for rapid inspection and thorough cleaning. A lever opens the cylinder housing exposing the concaves, cylinders, and shaft (figure 4). In most cases the machine can be cleaned by increasing the

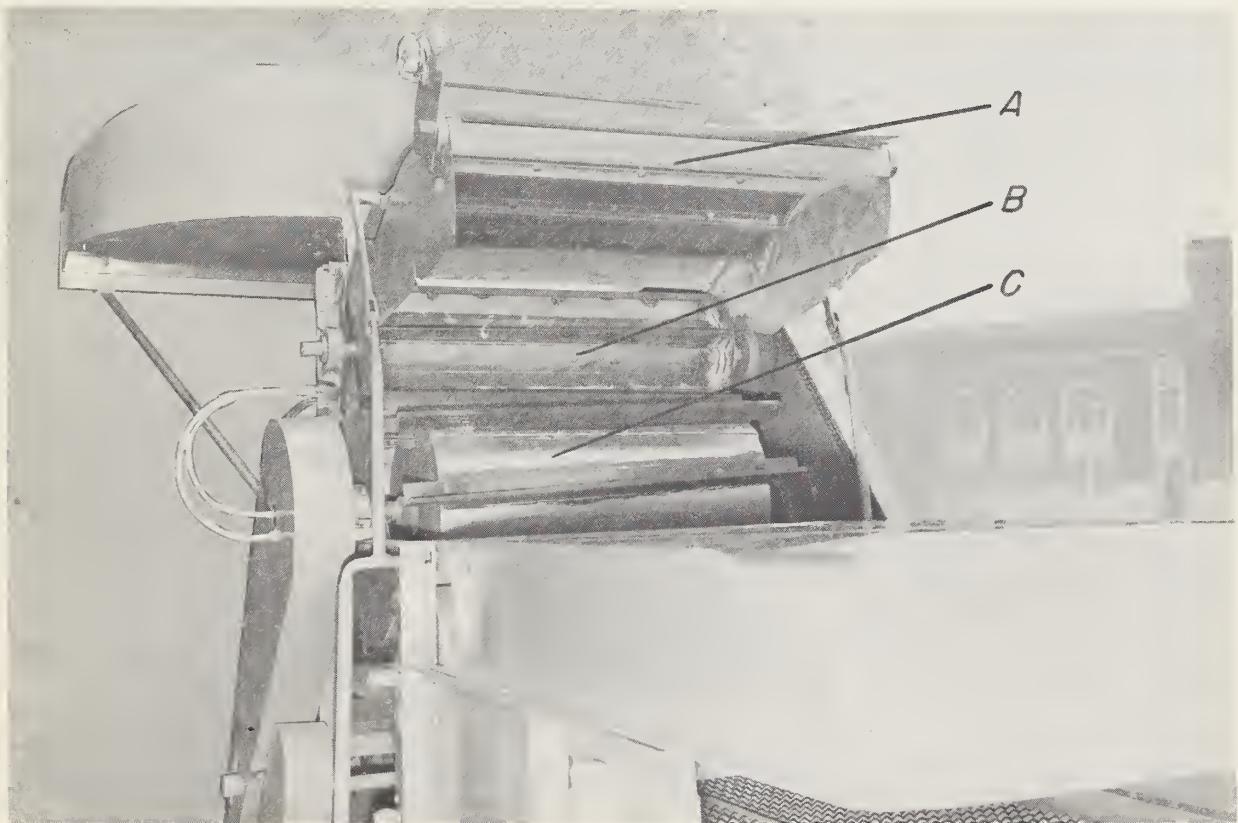


FIGURE 4. --Plot thresher with lever-operated hood in the open position for ease of cleaning and inspection: A, Concaves; B, feeder cylinder; and C, threshing cylinder

cylinder speed to around 2,000 rpm and opening the sieve. The sieve cover and back of the seed hopper are hinged so that they are raised and lowered, respectively, to expose the sieve from above and below for inspection. When identical materials are threshed, approximately 15 seconds are required for the machine to run clean and empty the seed pan. When different species or varieties are threshed and seed mixtures must be prevented, about 2 minutes are required to thoroughly clean and inspect the unit.

This machine, when continuously fed, can handle about 30 pounds per minute of wheat straw and 10 to 20 pounds per minute of grass seed plant material. Approximately three horsepower is required to drive the fully loaded thresher. It is designed so that the machine can be operated with either a gasoline engine or an electric motor. V-belts are used on high-speed machine parts and chain drives for the low-speed parts. The machine costs about \$2,000 for labor, materials and parts.

The plot thresher has been in use for three seasons at the Oregon Agricultural Experiment Station. The several thousand plot samples threshed include birdsfoot and big trefoils; white, sub, and crimson clovers, vetches; and peas. Cereal and forage grasses threshed include: wheat, oats, barley, proso millet, red fescue, chewings fescue, tall fescue, tall and intermediate wheatgrass, perennial and common ryegrasses, tall oatgrass, Merion Kentucky bluegrass, orchard grass, and bentgrasses. Miscellaneous crops include buckwheat and burnet.